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NEW SPECIES AND PHYLOGENETIC ANALYSIS OF *EUARESTA* LOEW (DIPTERA: TEPHRITIDAE), WITH A KEY TO THE SPECIES FROM THE AMERICAS SOUTH OF MEXICO

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Abstract.—***Euaresta regularis***, n. sp., and ***E. versicolor***, n. sp., are described based on specimens from southern Brazil, and *E. toba* (Lindner) and *E. reticulata* (Hendel) are redescribed. A lectotype is designated for *E. toba*, and *Tephritis apicata* Becker is considered a new synonym of *E. reticulata*. A key to species of *Euaresta* south of Mexico is provided, and a preliminary analysis of relationships among all the species of *Euaresta* is presented. New host plant and distribution data are reported for *E. toba* and *E. regularis*.

Resumen.—Se describen ***Euaresta regularis***, sp. n., y ***E. versicolor***, sp. n., de especimenes del sur de Brasil, y también *E. toba* (Lindner) y *E. reticulata* (Hendel). *Tephritis apicata* Becker es un sinónimo nuevo de *E. reticulata*. Se provee una clave a las especies de *Euaresta* del sur de México, y se presenta un análisis de las relaciones entre todas las especies de *Euaresta*. Se avisan registros nuevos de plantas huepedes y de distribución de *E. toba* y *E. regularis*.

Key Words: Fruit flies, Tephritidae, *Euaresta*, *Ambrosia*, *Xanthium*

Species of *Euaresta* Loew breed in ragweeds and cockleburs of the closely related composite genera *Ambrosia* L. and *Xanthium* L. (Asteraceae: Heliantheae) (Foote 1984). Because some of their host plants cause health problems (hayfever and other allergic reactions) and others are agricultural weeds, various *Euaresta* species have been investigated or introduced as biological control agents. In this paper I provide a key to the seven species of *Euaresta* known from Central and South America, only four of which were included in the most recent key (Aczél 1952). I also describe two new species closely related to *E. toba* (Lindner), redescribe the latter species and *E. reticulata* (Hendel), report new host data, and present a preliminary analysis of relationships among all of the species of *Euaresta*.

Materials and Methods

The morphological terminology used in this paper follows McAlpine (1981) and Norrbom and Kim (1988). The length of syntergosternite 7 was measured ventrally on undissected specimens. It may be slightly underestimated because the extreme base of this sclerite is often hidden by sternite 6. The length of the aedeagus, including the distiphallus, was measured (with difficulty) by stretching it to its full extent. Sample sizes included at least 5 males and 5 females, except in *E. versicolor* Norrbom, n. sp. Phylogenetic relationships were analyzed using Henning86 (Farris 1988, Fitzhugh 1989). Additional details are explained in the Relationships section. The following acronyms are used for depositories of specimens:

AMNH—American Museum of Natural History; BMNH—Natural History Museum (formerly British Museum [Natural History]), London; CAS—California Academy of Sciences; CMP—Carnegie Museum of Natural History, Pittsburgh; CNC—Canadian National Collection; DEI—Deutches Entomologisches Institut (formerly Institut für Pflanzenschutzforschung), Eberswalde; IML—Instituto Miguel Lillo, Tucumán; MCZ—Museum of Comparative Zoology, Harvard University; MNHNP—Muséum National d'Histoire Naturelle, Paris; MSUL—Michigan State University; NMW—Naturhistorisches Museum, Wien; SMNS—Staatliches Museum für Naturkunde, Stuttgart; SMT—Statliches Museum für Tierkunde, Dresden; UCD—University of California, Davis; USP—Museu de Zoologia, Universidade de São Paulo; USNM—National Museum of Natural History, Smithsonian Institution; USU—Utah State University, Logan; ZMUM—Zoological Museum, University of Moscow.

Taxonomic Synopsis of *Euaresta*

Species of *Euaresta* may be distinguished from other Tephritidae by the following combination of characters: postocular setae mixed short acuminate and long, swollen, white; scutal setulae swollen, white; 2 orbital setae, posterior one reclinate; dorsocentral seta closer to transverse suture than to level of postsutural supra-alar seta; parafacial spot absent; 1–2 scutellar setae (if 1, anterior notopleural seta absent); 2 frontal setae (1 in male of *E. versicolor*); head higher than long; mouthparts not geniculate, labella short; wing reticulate, with extensive markings on basal half; hind femur with anterodorsal and posterodorsal preapical setae; male fore femur swollen (except in *E. versicolor*); epandrium broad, often (*bullans* group) with striations on posterior surface.

Foote (1980) and Foote et al. (in press) provide keys by which *Euaresta* may be separated from other American genera. In *E. toba, E. regularis* Norrbom, n. sp., and *E. versicolor,* the apical pair of scutellar setae are small or absent, which may cause them to be misidentified as species of *Lamproxynella* Hering or *Dyseuaresta* Hendel. These three species may be be distinguished from all other American tephritid taxa by the absence of the anterior notopleural seta. Males of *Euaresta* may be recognized from other Tephritini by their swollen fore femur (except in *E. versicolor*) and by their broad, often posteriorly striate epandrium. Foote's (1980: 28) comment that these characters occur elsewhere in the Tephritini to my knowledge is incorrect. The species to which he referred in his discussion of *Plaumannimyia* belong in *Euaresta.* The male of *E. versicolor* is unusual in having only one frontal seta and small ocellar and orbital setae.

Euaresta is endemic to the Americas, although several species have been introduced into the Old World. With the addition of the two species described here, it includes a total of 14, although there are probably additional cryptic species in the *E. bellula* complex (Berlocher 1984). Some species have been placed in *Camaromyia* Hendel, now generally recognized as a synonym of *Euaresta.* Foote et al. (in press) reviewed the Nearctic species. In South America, seven species are now recognized. The most recent revision, by Aczél (1952), included *E. bullans, E. meridionalis* Aczél, *E. philodema* (Hendel), and *E. toba.* Steyskal (1972) transferred *E. reticulata* (Hendel) to *Euaresta* from *Plaumannimyia* Hering, and *E. versicolor* Norrbom, n. sp., and *E. regularis* Norrbom, n. sp., are described here.

Biology and Economic Importance

Species of *Euaresta* breed in the female flowers or developing seeds of their hosts. Foote (1984) summarized the known host data for the North American species. Those that have been released as biological control agents in the Old World include: *E. aequalis* (Loew), introduced to Australia and Fiji to

control common cocklebur, or Noogoora burr, *X. strumarium* L. (= *pungens* Wallr.); *E. bella* (Loew), released in eastern Europe to control common ragweed, *A. artemisiifolia* L.; and *Euaresta bullans* (Wiedemann), introduced, in some cases accidentally (Currie 1940), from South America to California, Europe, the Middle East, South Africa, and Australia, where it attacks spiny cocklebur, or Bathurst burr, *X. spinosum* L.

Host plant information is not as complete for the Neotropical species as for the Nearctic species of *Euaresta,* but hosts are known for four of the South American species. *Euaresta regularis* has been reared from *Ambrosia polystachya* DC. (C. Garcia, pers. comm.), and *E. toba* from *Ambrosia elatior* L. (R. McFadyen, pers. comm.), *A. tenuifolia* (H. Cordo, pers. comm.), and *A. cumanensis* H.B.K. (C. Garcia, pers. comm.). Both *E. bullans* and *E. philodema* breed in *Xanthium spinosum* and *X. catharticum* (Frias, in press; H. Cordo, pers. comm.). Aczél (1952) also erroneously listed *X. pungens* (a synonym of *X. strumarium,* the host of *E. aequalis*) as a host of *E. bullans.* In the book edited by Whyte that Aczél cited for this record, only the paper by Currie (1940) deals with *Euaresta,* and in that article, only *E. aequalis* is stated to attack *X. strumarium* (as *pungens*), and the only host given for *E. bullans* is *X. spinosum.*

Phylogenetic Relationships

This project originally concentrated on the four Neotropical species of *Euaresta* treated in the Taxonomy section, but because some characters were observed that seemed to have phylogenetic significance throughout the genus, the study was expanded to include a preliminary analysis of relationships among all of the species. Table 1 lists the 13 characters used in the analysis, and the distributions of their states are shown in Table 2.

The following character states are considered autapomorphies for individual species and were not included in the analysis: the broad, orange frons, the dark legs and abdomen, the straight margin of male sternite 5, and the unusual male chaetotaxy and microtrichial patterns in *E. versicolor* (see description); the nonmicrotrichose male sternite 5 in *E. toba*; the elongate syntergosternite 7 in *E. regularis*; the reduced eye size, and the orange syntergosternite 7 in *E. aequalis*; the arista color and shape, and the male antenna color in *E. bullans* (see key); and the bicolored wing pattern, and the even distribution and small size of the reticulations in the proximal ⅔ of the wing in *E. reticulata* (see key and Foote 1980, Fig. 66).

Euaresta belongs to the tribe Tephritini (Foote et al., in press), but its exact relationships within the tribe remain unclear. Because its sister group is uncertain, I examined representative species of all other New World genera of Tephritini to determine character polarities by outgroup comparison. For characters for which only one state occurs in all other Tephritini (i.e. characters 1, 2, 3, 5, 10, 13), polarities within *Euaresta* were easily hypothesized. For characters that vary among other Tephritini (e.g. characters 6, 7, 9 and 12), where possible I hypothesized the polarity that makes the character state distribution most congruent with those of characters of unequivocal polarity. For example, with character 7 polarized as in Table 1, the distribution of its states is congruent with that of character 5; reversing its polarity would cause homoplasy in regard to character 5. For these characters, it is interesting to note that the state coded plesiomorphic by the above method also is the more common state among other Tephritini, although I do not mean to imply that the common equals primitive method of determining character polarity should be used to support the character analysis. The polarities of several characters (4, 8, 11) could not be determined. These were coded with alternate states in the outgroup in a variety of preliminary analyses with little effect on the resulting trees (e.g. two steps are required for

Table 1. Characters used in phylogenetic analysis of species of *Euaresta*. State 0 is considered plesiomorphic, and transformation series are linear unless otherwise stated.

1. Epandrium width: 0) not broader than high; 1) broader than high.
2. Male fore femur: 0) similar to that of female; 1) much broader than that of female.
3. Anterior notopleural seta: 0) present; 1) absent.
4. Apical scutellar seta: 0) distinctly differentiated; 1) small or absent. Presence of the apical seta varies among other Tephritini.
5. Epandrium shape: 0) posterior side convex, without distinct ridges; 1) posterior side flattened or concave, with distinct ridges.
6. Syntergosternite 7 setulae: 0) slender, yellow; 1) swollen, white. Both states occur among other Tephritini, but with this polarity the character state distribution is congruent with that of character 5.
7. Epandrium color: 0) dark brown to black; 1) light brown or orange. State 1 occurs rarely in other Tephritini, but with this polarity the character state distribution is congruent with that of character 5.
8. Thorax ground color: 0) dark brown; 1) orange. State 1 occurs rarely in other Tephritini. The character state distribution is incongruent with those of several other characters and causes homoplasy when either state is coded plesiomorphic.
9. Cell r_{2+3}, number of apical hyaline spots: 0) 2; 1) 1. Wing pattern is highly variable among other Tephritini, but with this polarity the character state distribution is congruent with that of character 5.
10. Cell br basal spot: 0) small or absent; 1) large.
11. Apical dark rays: 0) very broad; 1) narrow to moderately broad. This character is difficult to code for *E. aequalis, E. versicolor, E. toba,* and *E. regularis.* Its polarity is uncertain because wing pattern is highly variable among other Tephritini (see text).
12. Bulla (i.e. small, dark dorsal concave area) in middle of cell r_{4+5}: 0) absent; 1) sometimes weakly present; 2) distinctly present. Occurrence of a bulla is rare in other Tephritini, and with this polarity the character state distribution is congruent with that of character 5.
13. Abdominal tergite microtrichia: 0) entirely microtrichose; 1) only male tergite 5 and female tergites 5–6 largely bare of microtrichia; 2) tergites 3–4 bare laterally in addition to most of tergites 5–6; 3) only male tergite 5 bare of microtrichia, female tergites entirely microtrichose. Nonmicrotrichose abdominal areas are rare in other Tephritini (e.g. in *Lamproxyna* Hendel, some *Pseudoedaspis* Hendel, some Old World genera) and where present they occur in different patterns, suggesting that states 1–3 are independently derived in *Euaresta.* State 3 and states 1–2 probably are independently derived from state 0.

Host: Amb = hosts are species of *Ambrosia*; Xan = hosts are species of *Xanthium.* Hosts are not included as a character in the phylogenetic analysis, but are listed in Table 2 and in Fig. 1 for convenience of comparison.

Biogeographic region: Ne = Nearctic; Nt = Neotropical. Distributions are not included as a character in the phylogenetic analysis, but are listed in Table 2 and in Fig. 1 for convenience of comparison.

character 8 no matter which polarity is hypothesized for it because in both cases it is incongruent with several other characters). These are further discussed below.

Analysis of the matrix in Table 2 by the implicit enumeration option (ie*) of Hennig86 resulted in four trees of 20 steps (consistency index = 80, retention index = 88). Successive weighting did not reduce the number of trees. The original trees differ from the Nelson consensus tree (Fig. 1) in having either *E. aequalis, E. reticulata,* or both grouped with *E. bullans, E. philodema,* and *E. meridionalis,* depending upon the interpretation of characters #6 and #7. The Nelson tree therefore is one step longer (length = 21 steps, consistency index = 76, retention index = 86).

The following are the significant results of the analysis. The broad epandrium (character #1) is a synapomorphy for *Euaresta.* This state does not occur in any other Tephritini. The swollen male fore femur (#2) is probably another synapomorphy of the genus, with reversal to the plesiomorphic state in *E. versicolor,* but it also may be interpreted as a synapomorphy for *E. toba* + *E. regularis,* and another for the bullans group.

Euaresta includes two monophyletic

Table 2. Matrix of character state distributions, hosts, and biogeographical regions (Reg.) of species of *Euaresta*. Numbers and abbreviations refer to characters, states, hosts, and regions listed in Table 1.

Species	Character													Host	Reg.
	1	2	3	4	5	6	7	8	9	10	11	12	13		
toba	1	1	1	1	0	0	0	0	0	0	1?	0	0	Amb	Nt
regularis	1	1	1	1	0	0	0	0	0	0	1?	0	0	Amb	Nt
versicolor	1	0	1	1	0	0	0	0	0	0	0?	0	3	?	Nt
reticulata	1	1	0	0	1	1	0	0	0	0	0	0	0	?	Nt
aequalis	1	1	0	0	1	0	1	1	0	0	0?	0	0	Xan	Ne
philodema	1	1	0	0	1	1	1	0	1	0	0	0	0	Xan	Nt
bullans	1	1	0	0	1	1	1	0	1	1	0	0	0	Xan	Nt
meridionalis	1	1	0	0	1	1	1	0	1	1	0	0	0	?	Nt
tapetis	1	1	0	0	1	0	0	0	0	0	0	1	0	?	Ne
festiva	1	1	0	0	1	0	0	1	0	0	1	2	0	Amb	Ne
bella	1	1	0	0	1	0	0	0	0	0	1	2	0	Amb	Ne
stigmatica	1	1	0	0	1	0	0	0	0	0	1	2	1	Amb	Ne
bellula	1	1	0	0	1	0	0	0	0	0	1	2	2	Amb	Ne
jonesi	1	1	0	0	1	0	0	0	0	0	1	2	2	Amb	Ne

groups, the *toba* group and the *bullans* group. The *toba* group includes *E. toba, E. regularis,* and *E. versicolor,* for which the loss of the anterior notopleural seta (#3) and the reduced apical scutellar seta (#4) are synapomorphies. The relationships among *E. toba, E. regularis,* and *E. versicolor* are poorly resolved. The closer relationship of *E. toba* and *E. regularis* is weakly supported only by character #11, which is difficult to

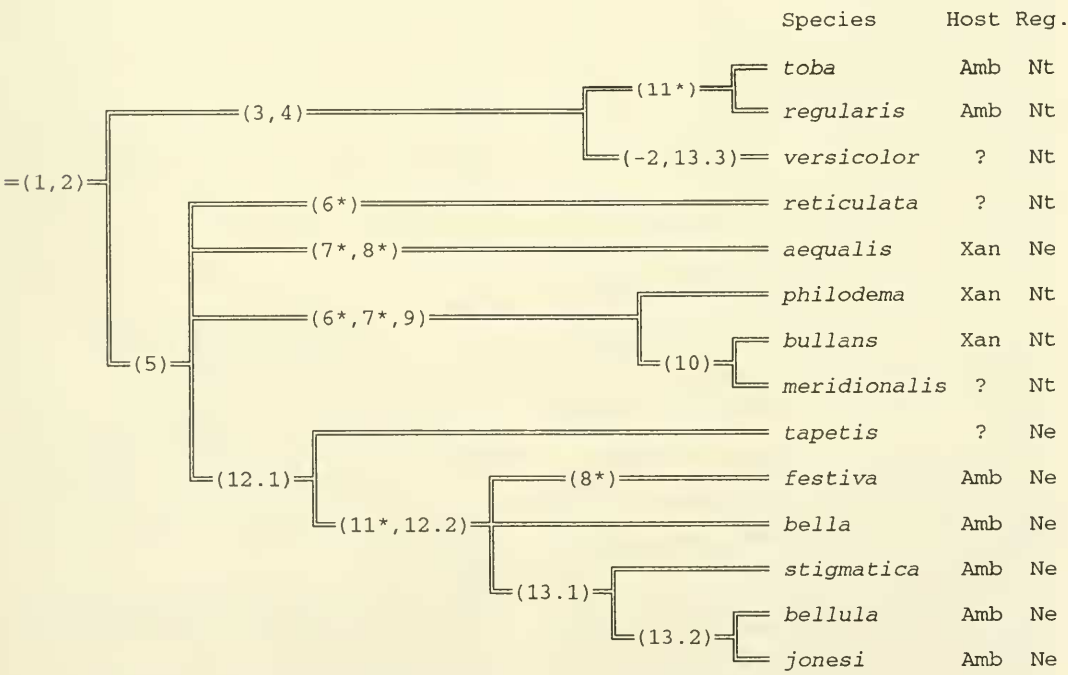

Fig. 1. Cladistic relationships among the species of *Euaresta*. Numbers and abbreviations refer to characters, states, hosts and distributions listed in Tables 1 and 2.

analyze (see below) and by one interpretation of character #2 (see above). Most characters that differentiate these three species are autapomorphies for one of them.

The *bullans* group includes all of the species of *Euaresta* other than *E. toba, E. regularis,* and *E. versicolor.* Its monophyly is supported by the shape of the epandrium, which is flattened or concave posteriorly, with strong ridges or striations (#5). Within the *bullans* group there are two monophyletic subgroups: *E. philodema, E. bullans,* and *E. meridionalis* form the *bullans* subgroup; and *E. tapetis, E. festiva, E. bella, E. stigmatica, E. bullula,* and *E. jonesi* comprise the *bella* subgroup. As stated above, *E. reticulata* is grouped most closely with the *bullans* subgroup by character #6, whereas *E. aequalis* is placed in this position by character #7.

The relationship of *E. tapetis* with the rest of the *bella* subgroup is based only on character state #12.1, which may not be reliable because the presence of a weak bulla in cell r_{4+5} is intraspecifically variable in *E. tapetis.* Also, if the polarity is reversed for character #11, which was difficult to code and polarize, some of the resulting trees group *E. tapetis* with the *bullans* subgroup, *E. aequalis,* and *E. reticulata.* A Hennig86 analysis of the matrix with the polarity reversed for character #11 produced 16 trees of 21 steps (consistency index = 0.76, retention index = 0.86). Except for sometimes placing *E. tapetis* with the *bullans* subgroup, they otherwise are similar to the trees of the first analysis except that the three species of the *toba* group sometimes form an unresolved trichotomy.

The hypotheses of phylogenetic relationships within *Euaresta* discussed above permit limited analysis of the biogeography of the genus. It should be noted that the introduction of *E. bullans* to California was presumably by man, sometime prior to 1903 when the types of *E. adspersa* Coquillett (= *bullans*) were collected. If the sister group of *Euaresta* is Neotropical, it is most parsimonious to assume that the genus originated in that region with two dispersals to North America, by the ancestor of the *bella* subgroup, and by *E. aequalis* or its ancestor. If the sister group is Nearctic or occurs in both regions, that hypothesis is equally likely to the following, that *Euaresta* originated in North America, with dispersals to South America by the ancestors of the *toba* group and *bullans* subgroup. Another dispersal event would be required if *E. aequalis,* rather than *E. reticulata,* is the sister group of the *bullans* subgroup.

The fact that all of the known hosts for *E. toba, E. regularis,* and the species of the *bella* subgroup are *Ambrosia* suggests that species of this plant genus may have been the original hosts of the common ancestor of *Euaresta.* Interesting questions that remain to be answered include whether all of the species that breed in *Xanthium* form a monophyletic group, and what the hosts are of the other species. If there has been only one shift from *Ambrosia* to *Xanthium* by *Euaresta,* the cladogram suggests that *E. versicolor* breeds in *Ambrosia,* and that *E. meridionalis* breeds in *Xanthium.* If *E. reticulata* is more closely related to the *bullans* subgroup than is *E. aequalis,* it probably also breeds in *Xanthium,* although if *E. aequalis* is closer, no host prediction can be made from the cladogram.

Taxonomy

Euaresta toba (Lindner)
(Fig. 2A, 3A)

Camaromyia toba Lindner 1928: 29 (Lectotype [here designated] ♂ (SMNS), ARGENTINA: [FORMOSA: Puesto] Misión Tacaaglé [Cué (24°56′S, 58°46′W)], XI.1925, E. Lindner); Aczél 1950: 296 [catalog].

Euaresta toba: Aczél 1952: 165 [taxonomy, distribution, additional references]; Foote 1967: 24 [catalog].

Diagnosis.—The male of *E. toba* is distinguished from those of all of the other

species of *Euaresta* south of Mexico by its shiny, nonmicrotrichose sternite 5. The female resembles that of *E. regularis,* but differs in having a shorter syntergosternite 7 and a less uniform wing pattern.

Description.—Body length 1.85–3.50 mm. Setae yellow. *Head:* Face white microtrichose. Frons yellow or gray, usually with distinct yellow ptilinal mark; at vertex 1.80–2.30 times as wide as eye. 2 frontal setae. 2 orbital setae. *Thorax:* Ground color mostly brown. Microtrichia dense, giving bluegray appearance. Mesonotum 0.69–1.09 mm long. Scutal microtrichia evenly white or gray. Scutal setulae all white or rarely all with orange tinge, evenly distributed except sometimes slightly denser along posterior margin. Anterior notopleural seta absent. Scutellum with setulae sometimes clustered; apical scutellar setae small, never longer than distance between basal setae, or sometimes absent. *Legs:* Entirely yellow. Male fore femur approximately 3 times as broad as fore tibia (distinctly broader than that of female). *Wing* (Fig. 2A): Extensively hyaline; cells br and dm more hyaline than brown, and with large basal hyaline areas; hyaline spots in cells br and dm, medial hyaline spots in cell r_{2+3}, and basal hyaline spot in cell r_{4+5} usually quadrate and as wide as cells containing them. Pattern of brown marks not uniform, marks uneven in size and distribution; cell cu_1 usually with basal brown mark large; brown mark in stigma and cells r_1, r_{2+3}, and br at least as wide as stigma. Stigma with large basal hyaline spot. Cell r_{2+3} with 2 marginal hyaline spots. Cell r_{4+5} with 2 subapical hyaline spots. *Male abdomen:* Tergites mostly yellow, often with large brown spot (usually paired), especially on tergite 5, occasionally mostly or entirely brown; setulae white, swollen, not clustered; microtrichia white, moderately dense, evenly distributed. Sternites 2–4 microtrichose. Sternite 5 (Fig. 3A) short trapezoidal, shiny, without microtrichia; posterior margin concave. Epandrium brown, similar in shape to *E. versicolor,* broad in posterior view (also see Aczél 1952, Fig. 29), but not strongly concave and without distinct ridges on posterior side. Aedeagus 0.91–0.95 mm long, 1.02–1.05 times as long as mesonotum. *Female abdomen:* Tergites yellow, often with large brown spot (usually paired), especially on tergites 4–6; setulae as in male. Tergites and sternites with moderately dense, evenly distributed, white microtrichia. Syntergosternite 7 brown, 0.59–0.83 mm long, 0.65–0.76 times as long as mesonotum; setulae yellow, acuminate. Aculeus tip (see Aczél 1952, Fig. 32) very slender, acute.

Remarks.—This is the most widespread Neotropical species of *Euaresta.* The record from El Salvador is the first for the genus from Central America. *Ambrosia cumanensis, A. tenuifolia,* and *A. elatior* are host plants (C. Garcia, H. Cordo, and R. McFadyen, pers. comm.). McFadyen (1976) also reported *A. tenuifolia* as a host, but this was a misidentification of *A. elatior* (R. McFadyen, pers. comm.).

Specimens examined.—Lectotype (see synonymy). ARGENTINA: Buenos Aires: Buenos Aires, 1♂1♀ (USNM); La Plata, Punta Lara, 30.XII.1969, Vardy, 1♀ (BMNH); San Isidro (Delta), S Bolle, I.1976, 4♂3♀ (CNC) 2♂1♀ (USNM). Chaco: Colonia Benitez, 7.XII.1949, R. Golbach, 2♂2♀ (IML). Cordoba: 19 mi N Taninga, emerged from seed head *Ambrosia tenuifolia,* 29.I.1990. 1♀ (USNM). Corrientes: 7 km SW Bella Vista, Hwy. 12, 16.I.1989, C. W. O'Brien, 1♀ (CAS). Entre Rios: La Paz, 14.XI (various years 1948–1961), M. Aczél, 2♂3♀ (IML) 2♀ (USNM). Formosa: Clorinda, XI.1947, I. Morel, 1♂ (IML); Isla de Cuba, 3.XII.1949, F. Monrós, 1♀ (IML); Lapango, XII.1926, E. Lindner, 1♀ paralectotype (SMNS); Puesto Misión Tacaaglé Cué, XI.1925, E. Lindner, 2♀ paralectotypes (SMNS). Misiones: Alto Parana, Bemberg, 1.XII.1933, K. J. Hayward, 1♀ (BMNH). Tucumán: Alpachiri, 29.XII.1949, Golbach, 2♂ (IML) 1♂1♀ (USNM); Cacavera, 23–28.XI.1951, Aczél, 1♂ (IML); Tucumán, fl. buds *Ambrosia ten-*

uifolia [misid. of *A. elatior*], XII.1975, R. E. McFadyen, 4♂4♀ (USNM). BRAZIL: Espirito Santo: Guaraparí, 25.I.1973, H. S. Lopes, 1♂ (USP). Para: Boca do Cuminá, Miri Oriximiná, Exp. Perm. Amaz., I.1968, 26♂17♀ (USP) 3♂4♀ (USNM). CHILE: Llanquihue, Casa Pangue, XII.1926, R. Shannon, 1♂ (USNM). Santiago, Cord. de la Costa, Cantillana, 2000 m, XII.1969, L. E. Peña, 9♂5♀ (USP) 3♂2♀ (USNM). COLOMBIA: Antioquia: Baranquilla, 5.X.1971, G. E. Bohart, 1♂1♀ (USU) 1♂ (USNM); Medellin, 2.X.1971, G. E. Bohart, 2♂2♀ (USU) 1♂1♀ (USNM). Boyacá: V. de Leiva, on flowers *A. cumanensis,* 30.VII.1991, C. Garcia, 1♂ (USNM). Cundinamarca: Fusagasugá, 1500 m, 15.X.1972, R. T. Schuh, 3♀ (AMNH) 1♀ (USNM). Tolima: Fresno, from seeds *Ambrosia cumanensis,* 3.VIII.1991, C. Garcia, 2♂2♀ (USNM). EL SALVADOR: San Salvador, X.1959, N. L. H. Krauss, 1♂ (USNM). PERU: 53 km N Chimbote, 16.III.1951, Ross, 1♀ (CAS); Chancay, river valley, 15.III.1951, Ross, 2♂ (CAS). URUGUAY: Montevideo: Montevideo, 15.I.1925, J. Tresnaleros, 1♂ (USNM). San José: Libertad, 4.III.1975, A. R. Wells, 3♂3♀ (MSUL) 1♂1♀ (USNM). VENEZUELA: Trujillo: La Mesa, 11.IX.1973, B. Villegas, 2♀ (UCD) 1♀ (USNM).

Euaresta regularis Norrbom, New Species
(Fig. 2B, 3B)

Holotype.—♀ (USP), BRAZIL: São Paulo: Barueri, 4.XII.1965, K. Lenko.

Paratypes.—BRAZIL: Minas Gerais: Sapucai mirim Cidade Azul, 1400 m, 7.XI.1953, L. Trav., 1♀ (USP). Paraná: Curitiba, from seeds of *Ambrosia polystachya,* 12.VI.1992, C. Garcia, 1♀ (USNM); Jaquariaiva, 29.I.1974, J. G. Rozen, 1♀ (AMNH). São Paulo: Barueri, 4.XII.1965, K. Lenko, 2♂ (USP, USNM); same, 5.II.1966, 1♀ (USP); same, 3.II.1968, 7♂7♀ (USP, USNM); Barão de Antonina, Itaporanga, I.1946, M. P. Barreto, 3♀ (USP, USNM); Camp. do Jordão, III.1953, L. Travassos & E. Rabello, 1♂ (USP); Eug. Lefevre, 1.XI.1937, Travassos, 1♀ (USNM); Monte Alegre, Faz. N. S. Incarnacão, 750 m, 14–27.X.1942, L. Trav. & Almeida, 3♀ (USP, USNM): Osasco, Vulcanoe Martinez, 20.XI.1955, 1♀ (USP); São Jose dos Campos, X.1933, H. S. Lopes, 1♀ (USNM); Sumaré, 5.I.1941, M. Carrera, 1♂1♀ (USP).

Diagnosis.—*E. regularis* closely resembles *E. toba,* but can be distinguished by its more uniform wing pattern. The female can be easily recognized because it is the only species of *Euaresta* in which syntergosternite 7 is longer than the mesonotum.

Description.—Body length 1.85-3.30 mm. Setae yellow. *Head:* Face white microtrichose. Frons yellow or gray, usually with distinct yellow ptilinal mark; at vertex 1.90–2.5 times as wide as eye. 2 frontal setae. 2 orbital setae. *Thorax:* Ground color mostly brown. Microtrichia dense, giving bluegray appearance. Mesonotum 0.79–0.95 mm long. Scutal microtrichia evenly white or gray. Scutal setulae white, evenly distributed. Anterior notopleural seta absent. Scutellum with setulae usually not clustered; apical scutellar setae small, never longer than distance between basal setae, or sometimes absent. *Legs:* Entirely yellow. Male fore femur approximately 3 times as broad as fore tibia (distinctly broader than that of female). *Wing* (Fig. 2B): Extensively hyaline; cells br and dm more hyaline than brown, and with large basal hyaline areas; hyaline spots in cells br and dm, medial hyaline spots in cell r_{2+3}, and basal hyaline spot in cell r_{4+5} usually quadrate and as wide as cells containing them. Most brown marks similar in size, giving more or less uniform appearance to pattern; cell cu_1 with basal brown mark small; brown mark in stigma and cells r_1 and r_{2+3} narrower than stigma. Stigma with large basal hyaline spot. Cell r_{2+3} with 2 marginal hyaline spots. Cell r_{4+5} with 2 subapical hyaline spots. *Male abdomen:* Tergites usually mostly yellow or light brown, except tergite 5 often predominantly dark brown; setulae white, swollen, not clus-

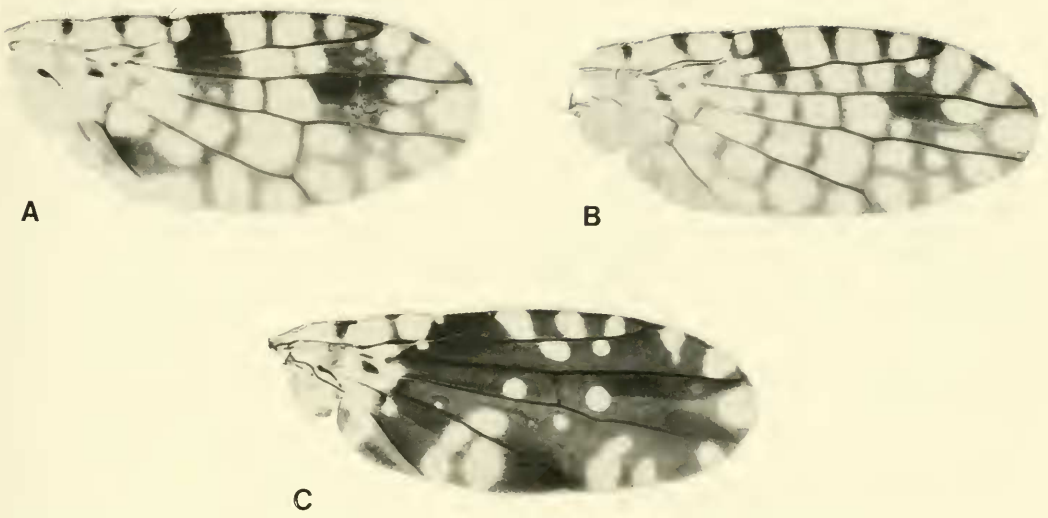

Fig. 2. Wings: A, *E. toba,* Brazil, Paraná, Boca do Cuminá; B, *E. regularis,* paratype, Brazil, São Paulo, Barueri; C, *E. versicolor,* holotype.

tered; microtrichia white, moderately dense, evenly distributed. Sternites 2–5 microtrichose. Sternite 5 (Fig. 3B) short trapezoidal; posterior margin concave. Epandrium brown, similar in shape to *E. versicolor,* broad in posterior view, but not strongly concave and without distinct ridges on posterior side. Aedeagus 1.11–1.41 mm long, 1.37–1.45 times as long as mesonotum. *Female abdomen:* Tergites yellow, often with large brown spot (usually paired). Setulae and microtrichia as in male. Syntergosternite 7 brown, 0.93–1.05 mm long, 1.09–1.20 times as long as mesonotum; setulae yellow, acuminate. Aculeus tip similar to *E. toba,* very slender, acute.

Remarks.—*Ambrosia polystachya* DC. is the only known host (C. Garcia, pers. comm.).

Etymology.—From the Latin, in reference to the uniform wing pattern.

Euaresta versicolor Norrbom, New Species
(Fig. 2C, 3C–G)

Holotype.—♂ (USP), BRAZIL: São Paulo: Barueri, 25.X.1955, K. Lenko, 3528.

Paratypes.—Same data as holotype, 1♂ (USP); same except 6.XII.1965, 1♀ (USNM). BRAZIL: São Paulo: Cipó, 15.X.1976, V. Alin, 1♀ (ZMUM); Monte Alegre, Faz. N. S. Incarnacão, 750 m, 14–27.X.1942, L. Trav. & Almeida, 1♂ (USNM).

Diagnosis.—Both the male and female of *E. versicolor* can be distinguished from all other species of *Euaresta* by their dark femora and extremely broad, orange frons. The male also is easily distinguished by its orange presutural scutal setulae, its unusual microtrichial pattern on the abdomen, its single frontal seta and reduced ocellar and orbital setae, and by its relatively unswollen fore femur (similar in width to that of female). The presutural scutal setulae are also denser in both the male and female of *E. versicolor* than in other species. The abdominal tergites are entirely brown, whereas they usually are at least partially yellow in other species.

Description.—Body length 2.70–3.20 mm. Setae yellow to brown. *Head:* Face bright white microtrichose. Frons with broad medial orange band or mostly orange, in addition to yellow ptilinal mark; at vertex 2.95–3.39 times as wide as eye. 1 frontal seta in male, 2 in female. 2 orbital setae,

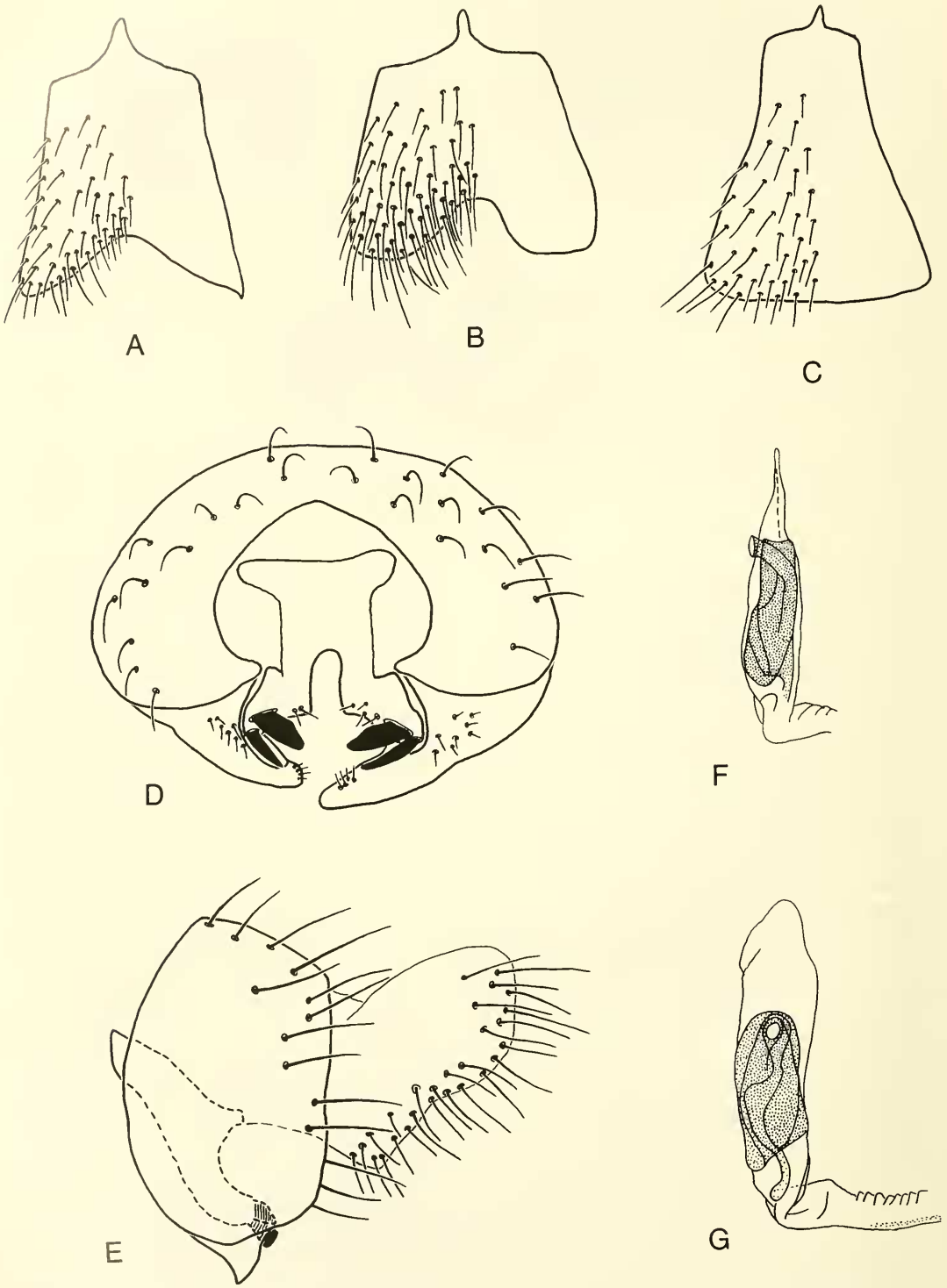

Fig. 3. Male terminalia: A, *E. toba,* Chile, Cordillera de la Costa; B, *E. regularis,* paratype, Brazil, São Paulo, Barueri; C–G, *E. versicolor,* paratype, Brazil, São Paulo, Barueri; A–C, sternite 5; D, epandrium and surstyli, posterior view; E, same, lateral view; F, distiphallus, ventral view; G, same, lateral view.

those and ocellar seta small in male. *Thorax:* Ground color mostly brown. Microtrichia dense, giving bluegray or brown appearance. Mesonotum 0.93–1.09 mm long. Scutal microtrichia white anteriorly; in female, gradually turned to gray posteriorly; in male, sharply turned to dark brown on posterior third of scutum and on scutellum. Scutal setulae small and dense anteriorly, sparse posteriorly except for row of larger setulae along margin; in male, presutural setulae bright orange. Anterior notopleural seta absent. Scutellum with cluster of small swollen white setulae; apical scutellar setae absent. *Legs:* Femora dark brown except apical ⅕–¼. Male fore femur approximately 2 times as broad as fore tibia and similar in width to that of female (in males of other species, it is 3 or more times as wide as the fore tibia). *Wing* (Fig. 2C): Mostly dark brown; cells br and dm more brown than hyaline; broad subbasal brown area from stigma to cell a_1 uninterrupted (in one specimen with small subbasal hyaline spots in cell dm); hyaline medial spots in cell r_{2+3}, basal hyaline spot in cell r_{4+5}, and all hyaline spots in cells br and dm usually ovoid and narrower than cell containing them. Stigma entirely brown or with small or large basal hyaline spot. Cell r_{2+3} with 2 marginal hyaline spots. Cell r_{4+5} with or without 1–2 subapical hyaline spots. *Male abdomen:* Tergites entirely brown; setulae yellow, acuminate except for subapical lateral tuft of small slightly swollen white setulae on syntergite 1 + 2. Syntergite 1 + 2 with dense black microtrichia in broad M-shaped pattern. Tergites 3–4 sparsely microtrichose, subshiny, except for narrow medial area of dense microtrichia. Tergite 5 without microtrichia. Sternites 2–5 microtrichose. Sternite 5 (Fig. 3C) elongate trapezoidal; posterior margin straight. Epandrium (Fig. 3D, E) brown, broad in posterior view, but not strongly concave and without distinct ridges on posterior side. Aedeagus 1.05 mm long, 1.13 times as long as mesonotum. *Female abdomen:* Tergites entirely brown; entirely and evenly lightly microtrichose; setulae all small, acuminate, yellow. Syntergosternite 7 brown, 0.71–0.75 mm long, 0.65–0.74 times as long as mesonotum; setulae yellow, acuminate. Aculeus tip similar to *E. toba,* very slender, acute.

Remarks.—The orbital setae may be difficult to recognize as such in the male because of their small size and location close to the eye due to the broad width of the frons in this species.

Etymology.—From the Latin, in reference to the colorful frons, microtrichia and setulae.

Euaresta reticulata (Hendel)

Trypanea reticulata Hendel 1914: 81 (Syntypes 10♂♀ (SMT, NMW), PERU: Lares Valley, 2000 m, 9.VIII; Cuzco, 3300 m, 19.VI; Tarma, 3000 m, 20.I; Sicuani, 19.VI; Arequipa, 19.XI; and Callabamba, 3000 m).

Tephritis apicata Becker 1919: 195 (Syntypes 5♂♀ (MNHNP, USP?), ECUADOR: environs of Tulcan; Riobamba, 2754 m; and Troya, 3513 m; 1902, Rivet). **New synonym.**

Plaumannimyia reticulata: Hering 1941: 158 [taxonomy; Peru]; Aczél 1950: 284 [catalog]; Foote 1967: 35 [catalog].

Plaumannimyia apicata: Foote 1967: 35 [catalog], 1980: 41.

Euaresta reticulata: Steyskal 1972: 130 [taxonomy; Colombia, Ecuador, Bolivia].

Diagnosis.—*E. reticulata* differs from all other species of *Euaresta* by its bicolored wing pattern, although based on this character alone it might be confused with some species of *Euarestoides* Benjamin and *Trypanaresta* Hering that have similar bicolored wings. Like other species of *Euaresta, E. reticulata* differs from *Euarestoides* in having 2 rather than 3 frontal setae, and from *Trypanaresta* in having a pair of small dorsal preapical setae on the hind femur.

Description.—Body length 2.90–4.40 mm. Setae yellow. *Head:* Face white micro-

trichose. Frons yellow or gray, usually with distinct yellow ptilinal mark; at vertex 1.75–1.95 times as wide as eye. 2 frontal setae. 2 orbital setae. Arista slender, brown except for slightly swollen basal ⅕ yellow. *Thorax:* Ground color mostly brown. Microtrichia dense, giving bluegray appearance. Mesonotum 1.13–1.76 mm long. Scutal microtrichia evenly white or gray. Scutal setulae white, evenly distributed. Anterior notopleural seta present. Scutellar setulae not clustered; apical scutellar seta present, usually at least as long as distance between basal setae. *Legs:* Entirely yellow. Male fore femur at least 3 times as broad as fore tibia (distinctly broader than that of female). *Wing* (see Foote 1980, Fig. 66): Almost entirely infuscated gray or light brown, with evenly distributed small hyaline spots, except for large dark brown subapical spot extended from apex of cell r_1 into cell m; apical rays extended from subapical spot also often darker than more basal infuscation. Hyaline spots in cells br, r_{2+3}, r_{4+5}, and dm usually ovoid and narrower than cells containing them. Cell dm with 6–9 hyaline spots. Stigma usually with 2 small hyaline spots. Cell r_{2+3} with 2 or rarely 3 marginal hyaline spots. Cell r_{4+5} with 2 subapical hyaline spots. *Male abdomen:* Tergites usually mostly brown (usually appearing bluegrey due to microtrichia) with yellow posterior margin, syntergite 1 + 2 and tergites 3–4 often more yellow with large brown spot (usually paired); setulae white, swollen, not clustered; microtrichia white, moderately dense, evenly distributed. Sternites 2–5 microtrichose. Sternite 5 short trapezoidal; posterior margin concave. Epandrium brown, strongly flattened or concave posteriorly, with distinct oblique ridges. *Female abdomen:* Tergites usually brown except posterior margin usually and middle sometimes yellow; setulae and microtrichia as in male. Syntergosternite 7 brown, 0.88–1.11 mm long, 0.60–0.79 times as long as mesonotum; setulae swollen, white. Aculeus tip very slender, acute.

Remarks.—I am formalizing the synonymy of *Tephritis apicata* Becker with *E. reticulata.* This action was suggested by Foote (1980), who nevertheless continued to classify *T. apicata* in *Plaumannimyia.* I see no significant differences from *E. reticulata* in Becker's description of *T. apicata* and his Fig. 5 of the wing, nor between specimens from the same collections series as the syntypes of these two nominal species. The male in the USP collection from Ecuador, "env. de Tulcan" may be a syntype or at least is from the same collection series as some of the syntypes of *T. apicata.* It has a handwritten label with "Tephritis apicata Bck." and its locality data are on a "MUSEUM PARIS" label. The Schnuse specimens from Arequipa, Cuzco, Sicuani, and Tarma, Peru in the AMNH and DEI collections are not syntypes of *T. reticulata,* but they come from the same large collection series.

Specimens examined.—BOLIVIA: La Paz: Estr. de Quitina, 30.IX.1972, G. E. Bohart, 2♂2♀ (USU) 1♂1♀ (USNM); La Paz, 4.X.1972, G. E. Bohart, 3♂2♀ (USU) 1♂ (USNM). COLOMBIA: La Combre, 18.V.1914, H. S. Parish, 1♀ (USNM). Cundinamarca: Fusagasugá, 1500 m, 15.X.1972, R. T. Schuh, 1♂ (AMNH). Nariño: Pasto, 28.IX.1954, M. Revelo, 1♀ (USNM); Pasto, 14–15.VII.1955, R. F. Ruppel, 2♂2♀ (USNM); Pasto, 2700 m, 9.XII.1955, L. Posada, 1♂2♀ (USNM); Pasto, 6.X.1958, A. Unigarro, 8♂7♀ (USNM); Pasto, 6.IX.1960, G. Bravo, 2♂2♀ (USNM); Pasto, 2600 m, 1969, 1♂ (USNM). ECUADOR: Baños, 19–20.II.1937, S. W. Frost, 1♂2♀ (USNM). Moya, E. de Alausi, 2500 m, XI.1970, L. E. Peña, 1♀ (USP). San Miguel, 30.XI.1955, H. R. Yust, 1♀ (USNM). Bolívar: Guaranda, 18.XI.1957, G. Marino, 9♂9♀ (USNM). Cañar: 1 km SE Cañar, 10,200 ft., [collected on] *Polymnia fruticosa* (USNM #6621), 30.I.1974, R. M. King, 1♂2♀ (USNM). Carchi: env. de Tulcan, 1902, G. Rivet, 1♂ [possibly a syntype of *T. apicata*] (USP). Chimborazo: Riobamba, 2700 m, 20.IV.1939, F. M. Brown, 1♂1♀ (USNM). Cuenca: Azuay, 25.II.1939, F. M. Brown, 1♂1♀ (AMNH). Loja: Loja, 2500 m, 23–25.III.1965, L. E.

Pena, 1♂1♀ (CNC). Napo: Pastaza, Pambay, Levi-Castillo, 1♀ (USNM). Pichincha: 20 km S Quito, 9200 ft., [collected on] *Ambrosia artemisioides* (USNM #6515), 18.I.1974, R. M. King, 1♂1♀ (USNM); 2 km S Aloag, 10,300 ft., [collected on] *Ambrosia artemisioides* (USNM #6515), 18.I.1974, R. M. King, 1♂ (USNM). Tungurahua: Ambato, 2555 m, 7.II.1955, E. S. Ross, 1♂3♀ (CAS); Tunga Farm, 6.III.1969, G. Merino, 3♂3♀ (USNM). PERU: Tia Baya, Cockerell, 1♂ (USNM). Apurímac: Abancay, 11.VII.1960, Young, 1♀ (USNM); 5 mi N Andahuaylas, 7.III.1951, Ross, 1♀ (CAS). Arequipa: Arequipa, 13.XI.1902, Schnuse, 1♀ (DEI). Cuzco: Cuzco, VIII.1973, B. V. Ridout, 3♀ (BMNH); Cuzco, 3500 m, 5.VII.1905, Schnuse, 1♂ (AMNH): Cuzco, 3300 m, 5–12.VIII.1965, P. Wygodzinsky, 1♂ (AMNH); Cuzco, 12,000 ft, 19.II.1947, J. C. Pallister, 2♀ (USNM); Cuzco, 20.II.1968, A. Garcia, 1♀ (MCZ); Cuzco, Quebradas Salineras, 3500 m, 3.VIII.1971, C. Vardy, 1♂1♀ (BMNH) 1♂ (USNM); 8 km S Cuzco, 3500 m, 6.VIII.1971, C. Vardy, 1♂2♀ (BMNH); NW Cuzco, Barrio Magisterial, 3500 m, 8.VIII.1971, C. Vardy, 3♂ (BMNH); 30 km S Cuzco, Lucre, 3550 m, 4.VIII.1971, C. Vardy, 1♂ (BMNH); Quispicamchis, Huamputio, 2900 m, 1.IX.1988, A. Freidberg, 1♀ (USNM); Sacsayhuaman, 3900 m, 5.VIII.1971, C. Vardy, 1♂3♀ (BMNH); Sicuani, 22.VI.1902, Schnuse, 1♂1♀ (DEI); Urubamba, 2900 m, 9.VIII.1971, C. Vardy, 1♂1♀ (BMNH) 1♂ (USNM). Huánuco: Huánuco, 16.IX.1954, E. S. Ross, 1♀ (CAS). Junín: 4 mi E Acobambo, 31.XII.1954, E. S. Ross, 1♀ (CAS); Tarma, 3000 m, 20.I.1904, Schnuse, 1♂ (DEI) 1♀ (AMNH); Tarma, 10,000 ft, 13.VII.1928, R. C. Shannon, 1♀ (USNM); Tarma, 30–31.V.1920, 1♀ (AMNH). Lima: Matucana, 14.VI.1914, H. S. Parish, 3♂1♀ (USNM). Piura: Huancabamba, 13.VIII.1945, P. A. Berry, 1♂ (USNM).

Euaresta sp.

Remarks.—A few specimens from Cuba and the Dominican Republic that I examined are very similar to specimens of *E. bella* (Loew) from the United States, but the males usually have most of tergite 5 nonmicrotrichose. Whether they are conspecific with United States populations requires further investigation. None of the Antillean specimens have a second hyaline spot or an isolated medial brown spot in the pterostigma as often occurs in *E. stigmatica* (Coquillett). No host data are known for them.

Specimens examined.—CUBA: Havana, Baker, 1♀ (CAS); San Diego de los Baños, 1♀ (USNM). DOMINICAN REPUBLIC: Pedernales: 30 km N Cabo Rojo, 1070 m, 23–24.VII.1990, C. Young, 4♂5♀ (CMP); 37 km N Cabo Rojo, 1500 m, 11.VII.1987, R. Davidson, 1♂1♀ (CMP); 7.3 km NNE Las Mercedes, Las Abejas, 1100–1150 m, 20.VIII.1983, F. M. Harrington, 3♂ (USNM).

Key to Species of *Euaresta* of America South of Mexico

I have included couplet 5 in this key in case any of the seven North American species that would run to the second alternative of the couplet are eventually found south of Mexico. None of them is currently known from Central or South America, although *E. bella* (Loew) was reported from the Bahamas and Lesser Antilles (Foote 1967) and specimens that may be *E. bella* are known from Cuba and the Dominican Republic (see "*Euaresta* sp."). Couplets 6 and 7 of this key are based on characters given by Aczél (1952). Some specimens I examined were difficult to identify in couplet 7 as either *E. philodema* or *E. meridionalis*. These species may have variable wing patterns or may be part of a species complex.

1. Anterior notopleural seta absent. Apex of cell r_{2+3} with 2 marginal hyaline spots. Apical scutellar seta absent or small, often white. Small species, mesonotum length less than 1.20 mm 2
– Anterior notopleural seta present. Apex of cell r_{2+3} with 1–2 marginal hyaline spots. Apical scutellar seta present, usually large and yellow. Large species (at least those that occur south of Mexico), mesonotum length usually more

than 1.30 mm 4

2. Femora largely brown. Wing (Fig. 2C) mostly dark brown, with broad subbasal dark band from stigma to cell a_1; hyaline medial spots in cell r_{2+3}, basal hyaline spot in cell r_{4+5}, and all hyaline spots in cells br and dm small, none as wide as cell containing them. Frons mostly orange, at vertex at least 2.9 times as wide as eye ..... *versicolor* Norrbom, n. sp.
– Femora entirely yellow. Wing (Fig. 2A, B) with hyaline areas in total as extensive as dark brown areas, without subbasal dark band (if large dark marks present on stigma and basally in cell cu_1, separated by largely hyaline basal areas in cells br and dm); most hyaline spots in cells br, r_{2+3}, r_{4+5}, and dm as wide as cells containing them. Frons yellow and gray, at vertex no more than 2.5 times as wide as eye 3
3. Wing (Fig. 2A) with dark marks on stigma, base of cell cu_1, and middle of cells r_{2+3} and r_{4+5} much larger than other dark marks giving uneven appearance to pattern; basal dark mark in cells r_1 and r_{2+3} as wide as stigma. Female syntergosternite 7 length 0.59–0.83 mm, 0.65–0.76 times length of mesonotum. Male sternite 5 without microtrichia, shiny ..... *toba* (Lindner)
– Wing (Fig. 2B) with most dark marks similar in size, giving more or less uniform appearance to pattern; basal dark mark in cells r_1 and r_{2+3} narrower than stigma. Female syntergosternite 7 length 0.93–1.05 mm, 1.09–1.20 times length of mesonotum. Male sternite 5 microtrichose, matte ..... *regularis* Norrbom, n. sp.
4. Wing (see Foote 1980, Fig. 66) with infuscated areas faint except for large dark brown subapical spot extended from apex of cell r_1 into cell m; most hyaline spots much narrower than cells containing them; cell dm with 6–9 hyaline spots; apex of cell r_{2+3} with 2 marginal hyaline spots ..... *reticulata* (Hendel)
– Wing (see Aczél 1952, Figs. 1–6) with more proximal infuscated areas as dark as subapical spot; most hyaline spots as wide as cells containing them; cell dm with 2–3 hyaline spots; apex of cell r_{2+3} with 1–2 marginal hyaline spots 5
5. Apex of cell r_{2+3} with 1 marginal hyaline spot; cell r_{4+5} without medial bulla 6
– Apex of cell r_{2+3} with 2 marginal hyaline spots; cell r_{4+5} often with medial bulla (North America and Antilles) see key of Foote et al. (in press)
6. Wing (See Aczél 1952, Figs. 1, 2) with subapical dark spot broader in cell r_{4+5} than in cells r_1 and r_{2+3}. Arista with basal half swollen and white; male with pedicel and first flagellomere dark brown ..... *bullans* (Wiedemann)
– Wing with subapical spot narrower in cell r_{4+5} than in cells r_1 and r_{2+3}. Arista with only basal ⅛ or less swollen and yellow; male antenna entirely yellow 7
7. Wing (see Aczél 1952, Figs. 3, 4) with basal dark spot in cell br large, oval, extended well into cell bm ..... *meridionalis* Aczél
– Wing (see Aczél 1952, Figs. 5, 6) with basal dark spot in cell br small, usually quadrate or linear, at most extended slightly into cell bm ..... *philodema* (Hendel)

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